Induced abortion and anxiety, mood, and substance abuse disorders: Isolating the effects of abortion in the national comorbidity survey

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ABSTRACT

The purpose of this study was to examine associations between abortion history and a wide range of anxiety (panic disorder, panic attacks, PTSD, Agoraphobia), mood (bipolar disorder, mania, major depression), and substance abuse disorders (alcohol and drug abuse and dependence) using a nationally representative US sample, the national comorbidity survey. Abortion was found to be related to an increased risk for a variety of mental health problems (panic attacks, panic disorder, agoraphobia, PTSD, bipolar disorder, major depression with and without hierarchy), and substance abuse disorders after statistical controls were instituted for a wide range of personal, situational, and demographic variables. Calculation of population attributable risks indicated that abortion was implicated in between 4.3% and 16.6% of the incidence of these disorders. Future research is needed to identify mediating mechanisms linking abortion to various disorders and to understand individual difference factors associated with vulnerability to developing a particular mental health problem after abortion.

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1. Introduction

Does induced abortion carry the potential to adversely affect the psychological well-being of women? This seemingly straightforward question is complicated by a number of characteristics inherent in the variables of interest as well as external factors surrounding investigative efforts. Diverse personal, relational, situational, and cultural forces converge in every woman's decision to abort and adjustment afterwards is likewise embedded in a multifaceted context rendering it difficult to tease out effects of the procedure. The private, sensitive, and frequently distressing nature of the abortion experience also introduces challenges to data collection with many women declining to participate or dropping out mid-study resulting in potentially skewed results. Finally, as a topic of academic study with bearing on a divisive social issue that engenders strong emotion, the socio-political views of researchers, reviewers, and journal editors may compromise objectivity in data collection, analysis, interpretation, and publication.

Despite these obstacles, the international literature pertaining to abortion as a predictor of adverse mental health outcomes has grown considerably in the past several decades and the rigor of the published studies has increased. Bradshaw and Slade (2003), authors of an extensive review of published studies on abortion and emotional experiences concluded "There has been increasing understanding of abortion as a potential trauma" (p. 929) and "The quality of studies has improved, although there are still some methodological weaknesses" (p. 929). In a review by Thorp et al. (2003) employing strict inclusion criteria related to sample size and length of time before follow-up, the researchers concluded that induced abortion increased the risk for "mood disorders substantial enough to provoke attempts of self-harm." (p. 67).

Employment of national data sets with reproductive history and mental health variables collected for broad investigative purposes greatly minimizes the potential for bias in data collection and low consent-to-participate rates which might otherwise compromise research on abortion. Large government funded data collection efforts have the benefit of employing professionally trained researchers or clinicians who are blind to the hypotheses of potential studies generated from the data. Further, the integrity and utility of data is maximized when trained professionals interview respondents to determine if they have experienced the symptoms of various disorders. Large-scale, national data sets also typically contain numerous personal and family history background variables that can be conveniently used as control variables.

Unfortunately the number of studies employing large representative samples with controls for third variables likely to be related to both the choice to abort and to the development of mental

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health problems remains rather small or non-existent for some disorders. Nevertheless, there are studies with nationally representative samples and a variety of controls for extraneous variables indicating an induced abortion puts women at risk for depression (Cougle et al., 2003; Fergusson et al., 2006; Pedersen, 2008; Rees and Sabia, 2007), anxiety (Cougle et al., 2005; Fergusson et al., 2006), and substance abuse (Coleman, 2006; Fergusson et al., 2006; Pedersen, 2007; Reardon et al., 2004). Only one of these studies incorporated a comprehensive measure of mental health problems, leading to insight regarding the likelihood that women who have an abortion will develop an actual diagnosable psychological disorder (Fergusson et al., 2006).

There are a few studies employing national samples that have failed to detect significant associations between abortion and subsequent mental health (Gilchrist et al., 1995; Schmiege and Russo, 2005). However, in the Gilchrist et al. study, very few controls were applied for confounding third variables. As a result, the comparison groups may very well have differed systematically with regard to income, relationship quality including exposure to domestic violence, social support, and other potentially critical factors. The attrition rate in this study was very high and there were additional methodological shortcomings. In the Schmiege and Russo (2005) study central analyzes lacked controls for variables identified as significant predictors of abortion (higher education, income, and smaller family size). Without the controls, the delivery group, which was associated with lower education and income and larger families, had more depression variance erroneously attributed to pregnancy resolution.

In a recently published qualitative paper by Goodwin and Ogden (2007), the authors concluded that "women's responses to their abortion do not always follow the suggested reactions of grief, but are varied and located within the personal and social context" (p. 231). This reality underscores the necessity of employing sufficient controls for confounding variables. All the large-scale studies described above controlled for an assortment of basic demographic variables including age, marital status, social support, number of children, and education. Many of these studies also included control variables indicative of pre-abortion mental health. However, a handful of very recent studies have gone a step beyond and included experiential variables that may be related to the choice to abort and to mental health outcomes. Among the variables in this latter category are relationship problems and childhood or adult history of physical and/or sexual abuse (Fergusson et al., 2006; Pedersen, 2007, 2008).

There is ample evidence indicating adverse interpersonal experiences, particularly abuse of various forms, predisposes individuals to emotional problems and mental illness (Adams and Bukowski, 2007; Fergusson et al., 1996; Ferraro and Johnson, 1983; Neria et al., 2008; Schilling et al., 2007; Zlotnick et al., 2000). Women who experience intimate partner violence are also more likely to abort compared to women who were not victimized (Silverman et al., 2007), necessitating the advent of controls for these personal history variables in studies of abortion and mental health.

No existing studies of abortion and mental health have included all the above categories of potential third variables in addition to incorporating variables suggestive of other sources of significant stress in women's lives. One obvious factor that should be controlled is history of miscarriage or stillbirth as non-voluntary forms of perinatal loss have been linked with mental health problems including anxiety and depression (Broen et al., 2005). Miscarriages are common, with estimates ranging from 25% to 43% of women experiencing at least one in their lifetime (Cote-Arsenault and Dombeck, 2001), underscoring the need to collect data on involuntary perinatal loss and control for it in research on the mental health effects of abortion. Serious accidents or life threatening illnesses, chronic health problems, heavy familial demands, and difficulty paying bills are relatively common stressors that should be controlled as well. Social support is another variable that may differ systematically based on abortion choice and/or mental health status and there is research indicating that women who have a strong support system are less likely to be harmed by an abortion (Major et al., 1990).

The purpose of the current study was to explore associations between abortion history and a wide range of anxiety (panic disorder, panic attacks, PTSD, agoraphobia), mood (bipolar disorder, mania, major depression), and substance abuse disorders (alcohol and drug abuse and dependence) using a nationally representative sample. In line with current research trends, the present study incorporates controls for 22 personal history and sociodemographic characteristics. Data from the national comorbidity survey were selected because the data base provides the most comprehensive epidemiological data on the prevalence of psychological disorders in the US. Given that most of the previously reviewed large-scale studies employing a variety of controls have detected an independent contribution of abortion to a variety of mental health concerns, abortion was hypothesized to have a similar effect with the present survey data, which employed more comprehensive assessments and a more expansive list of controls.

A few of the diagnoses examined herein have not been actively explored in the previous literature on abortion and mental health and inclusion will expand the range of outcomes that have been investigated. Although only one study has identified an association between abortion history and bipolar disorder (Coleman et al., 2002) an extensive literature review conducted by Alloy et al. (2005) revealed that individuals with bipolar disorder often experience an increase in stressful events before the onset and recurrences of mood episodes. Similarly no studies to date have examined a potential link between abortion and panic attacks or panic disorder, yet panic disorder is twice as common in women compared to men and research indicates a history of psychosocial stressors including trauma in many who experience panic episodes (Sansone et al., 1998).

Most of the diagnoses examined in this report have been identified as significant correlates of abortion; however the effects have not been isolated effectively due to insufficient controls for third variables. In the context of surveying and controlling for potential third variables, this study has the added benefit of providing useful data regarding the magnitude of a large number of individual and situational predictors of several different mental disorders. Oftentimes when the available evidence pertaining to abortion and mental health is debated, there is an assumption that the correlational evidence could likely be explained away by uncontrolled third variables. For example, some may argue it is not the abortion per se, but exposure to intimate partner violence that is behind both the abortion choice and ensuing mental health struggles. Quantification of these risks should bring some clarity to the debate.

2. Method

2.1. Data source

The national comorbidity survey (NCS) is widely recognized as the first nationally representative survey of mental health in the United States. The general purpose of the NCS was to study the prevalence and correlates of DSM III-R disorders and service utilization trends for these disorders (Kessler, 2008). The structured psychiatric interviews were administered by the Survey Research Center at the University of Michigan (UM), Ann Arbor, between September 14, 1990 and February 6, 1992.

2.2. Participants

The NCS employed a stratified, multi-stage area probability sample of individuals between the ages of 15 and 54 years who represented the non-institutionalized civilian population in the 48 coterminous United States. A response rate of 82.6% was achieved with a total of 8098 respondents participating in the survey. The NCS data relevant to this study include the following: a Diagnostic Interview administered to the entire study sample ($n = 8098$) and a Risk Assessment Interview administered to a subsample ($n = 5877$). Several of the study variables including abortion history and other potential risk factors for the various disorders were only assessed in the subsample. The current sample was therefore confined to the subsample and included all women for whom there were data available on all variables of interest: 399 women who had either one (77%) or more (23%) abortions and 2650 women who did not report an abortion. The average age for the first abortion was 21.8 (SD = 5.49) years with first abortion age spanning 14–37 years.

2.3. Procedure

The NCS employed 158 interviewers with an average of 5 years of prior experience interviewing at the Survey Research Center. Diagnoses were based on a modified version of the Composite International Diagnostic Interview (the UM-CIDI), developed at the University of Michigan and based on the diagnostic criteria of the DSM-III-R. The NCS interviewers went through an intensive training program in the use of the UM-CIDI.

In addition to interview responses, a series of indicator variables for psychiatric diagnoses were created by the staff. These are referred to as "DXDM variables" and were employed as the dependent variables in the current study. Some of these variables were created from items in the Diagnostic interview while others were created from items in the Risk Assessment Interview. The psychiatric illnesses were assessed as "present" or "absent" at the time of data collection providing assurance that in most cases, the abortion preceded the diagnosis.

Abortion history served as the independent variable in the current study. Twenty two different demographic, history, and personal/situational variables operated as control variables (see Table 1) in the logistic regression analyzes performed to assess independent contributions of abortion history to mental disorders from those most frequently linked to abortion in previous research (anxiety, mood, and substance abuse). The choice of control variables was driven by the literature reviewed previously indicating factors likely to predict the choice to abort and/or mental health problems.

Deriving accurate results from the NCS requires application of correct sample weights. In this study, necessary weighting was conducted as advised by the NCS authors in order to achieve nationally representative results.

3. Results

The control variables employed in this study are listed in Table 1. Significance tests (chi-square for dichotomous variables and *t*-tests for continuous dependent variables) revealed differences between women with and without abortion experience relative to marital status, race, number of residents in the respondent's household, employment status, educational attainment, feelings of being worthy/equal to others, history of miscarriage/stillbirth, rape, having been sexually molested in childhood, physically attacked in adulthood, and having experienced a life threatening accident. No differences were observed between the two groups relative to the degree to which the respondent relies on relatives

Table 1
Differences between the abortion and no abortion groups relative to demographic, history, and personal/situational variables employed as controls in primary analyzes.

Control variable	Abortion		No abortion		Significance
Age	32.8 (8.46)		31.4 (11.19)		$p = 0.017$
Income	$38,548 (25,853)		37,614 (26,472)		$p = 0.52$
Marital status	Married/cohabiting	58.6%	Married/cohabiting	58.7%	$p < 0.001$
	Sep/div/widow	19.9%	Sep/div/widow	11.2%	
	Never married	21.4%	Never married	30.2%	
Race	White	70.9%	White	75.9%	$p < 0.001$
	Black	17.9%	Black	11.8%	
	Hispanic	8.2%	Hispanic	9.5%	
	Other	2.9%	Other	3.6%	
Number in household	One	6.3%	One	3.7%	$p < 0.001$
	Two	26.2%	Two	23.9%	
	Three	32.2%	Three	24.8%	
	Four	18.7%	Four	25.9%	
	Five	9.3%	Five	12.8%	
	Six	6.4%	Six	4.4%	
	Seven+	0.8%	Seven	+ 4.4%	
Employment status	Student	4.4%	Student	15.6%	$p < 0.001$
	Working	72.8%	Working	61.3%	
	Homemaker	14.4%	Homemaker	17.5%	
	Other	8.4%	Other	5.7%	
Education	0–11 yrs	12.0%	0–11yrs	24.9%	$p < 0.001$
	12 yrs	40.3%	12 yrs	37.8%	
	13–15 yrs	26.1%	13–15yrs	23.1%	
	16+yrs	21.6%	16+yrs	14.2%	
Rely on relatives with problems	A lot	68.6%	A lot	75.0%	$p = 0.06$
	Some	18.4%	Some	14.5%	
	A little	7.0%	A little	6.2%	
	None	6.9%	None	4.3%	
Frequency relatives make demands	Often	14.8%	Often	11.8%	$p = 0.38$
	Sometimes	26.6%	Sometimes	28.2%	
	Rarely	39.4%	Rarely	39.1%	
	Never	19.3%	Never	30.9%	
Feels worthy/equal of others	Very true	61.0%	Very true	56.3%	$p = 0.03$
	Sometimes true	23.0%	Sometimes true	29.9%	
	A little true	12.1%	A little true	9.5%	
	Not at all true	3.9%	Not at all true	4.3%	
History of miscarriage/stillbirth	Yes	31.0%	Yes	18.7%	$p < 0.001$
	No	69.0%	No	81.3%	
Number of children	2.37 (0.168)		2.5 (0.049)		$p = 0.160$
Rape history	Yes	16.2%	Yes	9.6%	$p < 0.001$
	No	83.8%	No	90.4%	
Sexually molested in childhood	Yes	19.2%	Yes	13.3%	$p < 0.001$
	No	80.8%	No	86.7%	
Physically attacked in adulthood	Yes	13.7%	Yes	6.3%	$p < 0.001$
	No	86.3%	No	93.7%	
Physically abused as a child	Yes	7.5%	Yes	5.6%	$p = 0.140$
	No	92.5%	No	94.4%	
Neglected as a child	Yes	3.8%	Yes	4.3%	$p = 0.660$
	No	96.2%	No	95.7%	
Other terrible experience	Yes	10.6%	Yes	11.9%	$p = 0.470$
	No	89.4%	No	88.1%	
Life threatening accident	Yes	20.1%	Yes	12.5%	$p < 0.001$
	No	79.9%	No	87.5%	
Difficult to pay bills	2.70 (0.97)		2.73 (0.93)		$p = 0.641$
Health problems	3.84 (1.82)		3.96 (1.76)		$p = 0.221$

for problems, the frequency with which relatives make demands on the respondent, number of children, having been physically abused as a child, another terrible experience, difficulty paying bills, and health problems.

Table 2 provides the frequency of respondents in each independent variable group who met the Survey criteria for the various disorders. For every disorder, the abortion group had a higher frequency that was statistically significant. The disorders with the highest frequencies across both groups were alcohol abuse and

drug abuse "with or without dependence" and major depression. Lower frequencies were obtained for bipolar disorder and mania.

The results of the primary analyzes are presented in Tables 3–5. A series of 15 logistic regression analyzes with one mental health outcome operating as the criterion variable in each model were conducted. In each analysis the 22 control variables listed in Table 1 were entered into the equation. What is reported in the table for every mental health diagnosis is the strength of each significant predictor after the effects of all other predictors were removed. For the induced abortion variable both adjusted and unadjusted effects are provided. For 12 out of 15 of the mental health outcomes examined, abortion made a significant contribution independent of all control variables. For the anxiety disorders, which included panic disorder, panic attacks, PTSD, agoraphobia with or without panic disorder, agoraphobia without panic disorder, a history of abortion when compared to no history was associated with an 111%, 44%, 59%, 95%, and a 93% increased risk, respectively. With regard to substance abuse disorders, an induced abortion was associated with a 120%, 145%, 79%, 126% increased risk for alcohol abuse with or without dependence, alcohol dependence, drug abuse with or without dependence, and drug dependence, respectively. Finally, for the mood disorders, the experience of an abortion increased risk of developing bipolar disorder by 167%, major depression without hierarchy by 45% and major depression with hierarchy by 48%. The term "hierarchy" was applied to indicate that the condition was not better accounted for by another disorder.

The abortion variable made a significant independent contribution to more mental health outcomes than a history of rape, sexual abuse in childhood, physical assault in adulthood, physical abuse in childhood, and neglect which contributed to between four and ten different diagnoses. Other variables that made significant contributions to several disorders included age the respondent's family making frequent demands, health problems, experiencing a life threatening accident, race, lower income, feeling less worthy than others, religion, difficulty paying bills, employment, number of children with the majority of effects showing fewer children was a risk factor, more people in the household, miscarriage/stillbirth, experiencing other terrible life events, marital status, and education. The tendency to feel as though one could not rely on family for problems was only associated with one outcome. Specific are provided in Table 3.

Population attributable risk (PAR) percentages were calculated for each mental health problem. In order to calculate PAR when employing a retrospective design, population exposure must be estimated and odds ratios employed. The adjusted odds ratios provided in Tables 3–5 which reflect controls for the 22 potential third

Table 2
Number and percentage of women with each mental health problem based on abortion history.

Diagnosis	Abortion (%)	No abortion (%)	Significance
Panic disorder	11	6.3	p < 0.001
Panic attacks	18	12.3	p < 0.001
PTSD	19.8	11.5	p < 0.001
Agoraphobia w/or wo panic disorder	18	11.2	p < 0.001
Agoraphobia wo panic disorder	14	8.4	p < 0.001
Alcohol abuse w/or wo dependence	36.8	16.3	p < 0.001
Alcohol abuse wo dependence	14.6	7.8	p < 0.001
Alcohol dependence	23.4	9.6	p < 0.001
Drug abuse w/or wo dependence	23.6	9.7	p < 0.001
Drug abuse wo dependence	9.5	4.1	p < 0.001
Drug dependence	16.7	6.9	p < 0.001
Bipolar I	5.4	2.1	p < 0.001
New mania	1.7	0.5	p = 0.01
Major depression wo hierarchy	40.7	26.6	p < 0.001
Major depression w hierarchy	36.5	23.0	p < 0.001

Table 3
Results of logistic regression analyzes with anxiety diagnoses as the dependent variables.

Significant predictors	B	SE(B)	Exp(B)	T-statistic	Probability
DV: Panic disorder					
Age	0.054	0.013	1.056	4.135	0.000
Number in household	0.269	0.075	1.309	3.595	0.000
Number of children	−0.174	0.076	0.840	−2.284	0.023
Raped	−0.136	0.063	0.873	−2.160	0.031
Other terrible experience	−0.114	0.056	0.893	−2.026	0.043
Life threatening accident	−0.149	0.053	0.862	−2.794	0.005
Difficulty paying bills	−0.250	0.107	0.779	−2.328	0.020
Health problems	−0.103	0.048	0.902	−2.149	0.032
Abortion	0.748	0.227	2.113	3.295	0.001
Abortion(unadjusted)	0.608	0.184	1.837	3.306	0.001
DV: Panic attacks					
Age	0.025	0.010	1.025	2.555	0.011
Freq family makes demand	−0.193	0.072	0.825	−2.668	0.008
Feels worthy/equal to others	0.191	0.079	1.210	2.403	0.017
Number of children	−0.166	0.059	0.847	−2.805	0.005
Sexually molested as a child	−0.101	0.044	0.904	−2.298	0.022
Physically attacked/ assaulted	−0.105	0.053	0.900	−1.985	0.048
Physically abused as a child	−0.173	0.063	0.841	−2.750	0.006
Neglected as a child	0.207	0.082	1.230	2.519	0.012
Life threatening accident	−0.164	0.042	0.849	−3.929	0.000
Difficulty paying bills	−0.218	0.081	0.804	−2.695	0.007
Health problems	−0.119	0.037	0.887	−3.269	0.001
Abortion	0.362	0.185	1.436	1.962	0.050
Abortion (unadjusted)	0.441	0.147	1.550	2.995	0.001
DV: PTSD					
Age	−0.025	0.012	0.975	−2.075	0.038
Income	0.088	0.024	1.092	3.697	0.000
Marital status	0.402	0.137	1.494	2.934	0.003
Religion	−0.230	0.097	0.795	−2.377	0.018
Race	0.303	0.107	1.355	2.847	0.005
Rely on family w/problems	373	0.088	1.452	4.214	0.000
Raped	−0.556	0.051	0.574	−10.963	0.000
Sexually molested as a child	−0.208	0.049	0.812	−4.274	0.000
Physically attacked/ assaulted	−0.330	0.057	0.719	−5.782	0.000
Physically abused as a child	−0.441	0.066	0.644	−6.702	0.000
Neglected as a child	−0.180	0.078	0.835	−2.315	0.021
Other terrible experience	−0.198	0.055	0.820	−3.574	0.000
Life threatening accident	−0.150	0.051	0.861	−2.957	0.003
Difficulty paying bills	−0.258	0.099	0.773	−2.612	0.009
Health problems	−0.117	0.045	0.889	−2.626	0.009
Abortion	0.467	0.217	1.595	2.153	0.032
Abortion (unadjusted)	0.640	0.143	1.897	4.467	0.000
DV: Agoraphobia with or without panic disorder					
Employment	0.238	0.114	10.269	2.095	0.037
Feels worthy/equal to others	0.349	0.081	1.418	4.321	0.000
Raped	−0.180	0.052	0.835	−3.457	0.001
Physically attacked/ assaulted	−0.153	0.055	0.858	−2.814	0.005
Life threatening accident	−0.094	0.048	0.911	−1.970	0.049
Health problems	−0.083	0.040	0.921	−2.047	0.041
Abortion	0.670	0.192	1.954	3.492	0.001
Abortion (unadjusted)	0.560	0.148	1.751	3.785	0.000
DV: Agoraphobia without panic disorder					
Age	−0.026	0.012	0.974	−2.153	0.032
Employment	0.454	0.128	1.575	3.561	0.000
Freq family makes demand	−0.252	0.091	0.777	−2.771	0.006
Feels worthy/equal to others	0.269	0.094	1.309	2.870	0.004
Raped	−0.176	0.060	0.838	−2.931	0.004
Sexually molested as a child	0.187	0.069	1.206	2.695	0.007
Physically abused as a child	−0.218	0.076	0.804	−2.873	0.004
Health problems	−0.119	0.046	0.888	−2.595	0.010
Abortion	0.658	0.217	1.931	3.029	0.003
Abortion (unadjusted)	0.566	0.165	1.760	3.429	0.001

variables were used. The specific formulas selected to calculate the PAR percentages listed in Table 6 are provided below. As indicated by the data presented in Table 6, abortion accounted for between 4.3% and 16.6% of the incidence of the various disorders in the pop-

Table 4
Results of logistic regression analyzes with substance abuse/dependence diagnoses as the dependent variables.

Significant predictors	B	SE(B)	Exp(B)	T-statistic	Probability
DV: Alcohol abuse with or without dependence					
Education	−0.074	0.035	0.928	−2.151	0.032
Religion	0.202	0.066	1.224	3.058	0.002
Race	−0.529	0.109	0.589	−4.867	0.000
Freq family makes demand	−0.159	0.066	0.853	−2.405	0.017
Number of children	−0.132	0.056	0.876	−2.367	0.018
Sexually molested as a child	−0.097	0.041	0.908	−2.357	0.019
Physically attacked/assaulted	−0.106	0.050	0.899	−2.132	0.033
Physically abused as a child	−0.141	0.061	0.868	−2.321	0.021
Abortion	0.787	0.163	2.198	4.823	0.000
Abortion (unadjusted)	1.099	0.120	3.001	9.192	0.000
DV: Alcohol abuse without dependence					
Income	−0.042	0.021	0.959	−1.967	0.050
Religion	0.248	0.085	1.281	2.920	0.004
Race	−0.265	0.129	0.767	−2.052	0.041
Employment	−0.348	0.144	0.706	−2.421	0.016
Physically abused as a child	−0.169	0.080	0.845	−2.121	0.034
Neglected as a child	0.338	0.136	1.402	2.478	0.014
Abortion	0.290	0.230	1.337	1.259	0.208
Abortion (unadjusted)	0.703	0.163	2.020	4.302	0.000
DV: Alcohol dependence					
Race	−0.725	0.161	0.484	−4.490	0.000
Freq family makes demand	−0.176	0.082	0.839	−2.147	0.032
Raped	−0.139	0.052	0.870	−2.647	0.008
Abortion	0.895	0.188	2.448	4.764	0.000
Abortion (unadjusted)	1.051	0.139	2.860	7.568	0.000
DV: Drug abuse with or without dependence					
Age	−0.036	0.011	0.965	−3.149	0.002
Income	0.062	0.022	1.064	2.870	0.004
Religion	0.310	0.076	1.363	4.051	0.000
Race	−0.322	0.116	0.725	−2.767	0.006
Number in household	0.157	0.061	1.170	2.562	0.011
Freq family makes demand	−0.179	0.080	0.836	−2.229	0.026
History of miscarriage/ stillbirth	−0.137	0.041	0.872	−3.348	0.001
Number of children	−0.196	0.070	0.822	−2.785	0.006
Raped	−0.169	0.051	0.845	−3.295	0.001
Sexually molested as a child	−0.135	0.047	0.874	−2.859	0.004
Physically attacked/assaulted	−0.136	0.056	0.872	−2.447	0.015
Life threatening accident	−0.150	0.048	0.861	−3.144	0.002
Difficulty paying bills	−0.243	0.089	0.784	−2.723	0.007
Abortion	0.585	0.190	1.795	3.084	0.002
Abortion (unadjusted)	1.061	0.138	2.891	7.666	0.000
DV: Drug abuse without dependence					
Age	−0.060	0.018	0.942	−3.237	0.001
Income	0.158	0.041	1.171	3.889	0.000
Marital status	0.561	0.180	1.753	3.125	0.002
Sexually molested as a child	−0.285	0.065	0.752	−4.349	0.000
Difficulty paying bills	−0.320	0.138	0.726	−2.314	0.021
Abortion	0.140	0.304	1.150	0.460	0.646
Abortion (unadjusted)	0.908	0.202	2.478	4.502	0.000
DV: Drug dependence					
Age	−0.025	0.012	0.976	−2.004	0.046
Religion	0.288	0.085	1.334	3.392	0.001
Race	−0.289	0.131	0.749	−2.211	0.027
Feels worthy/equal to others	0.246	0.097	1.279	2.544	0.011
History of miscarriage/ stillbirth	−0.116	0.046	0.891	−2.531	0.012
Raped	−0.204	0.056	0.815	−3.655	0.000
Life threatening accident	−0.208	0.050	0.812	−4.146	0.000
Abortion	0.817	0.204	2.263	4.009	0.000
Abortion (unadjusted)	1.000	0.158	2.717	6.309	0.000

Table 5
Results of logistic regression analyzes with mood disorders as the dependent variables.

Significant predictors	B	SE(B)	Exp(B)	T-statistic	Probability
DV: Bipolar I					
Age	−0.054	0.024	0.948	−2.259	0.024
Marital status	0.489	0.240	1.631	2.041	0.042
Number in household	0.202	0.103	1.224	1.964	0.050
Employment	0.425	0.214	1.529	1.988	0.047
Feels worthy/equal to others	0.362	0.167	1.436	2.167	0.031
Raped	−0.254	0.095	0.776	−2.685	0.007
Neglected as a child	−0.396	0.120	0.673	−3.290	0.001
Other terrible experience	0.381	0.178	1.464	2.145	0.032
Abortion	0.983	0.357	2.672	2.752	0.006
Abortion (unadjusted)	0.949	0.266	2.583	3.564	0.000
DV: New mania					
Age	−0.349	0.126	0.706	−2.778	0.006
Education	0.830	0.360	2.293	2.304	0.022
Number in household	0.550	0.275	1.734	2.004	0.046
Employment	1.350	0.631	3.859	2.139	0.033
Freq family makes demand	−1.180	0.597	0.307	−1.979	0.048
History of miscarriage/ stillbirth	−0.410	0.147	0.664	−2.789	0.005
Number of children	0.806	0.267	2.240	3.020	0.003
Raped	−0.789	0.281	0.454	−2.807	0.005
Neglected as a child	−1.179	0.396	0.308	−2.973	0.003
Abortion	2.164	1.266	8.710	1.709	0.088
Abortion (unadjusted)	1.258	0.481	3.519	2.617	0.009
DV: Major depression without hierarchy					
Age	0.025	0.008	1.026	3.275	0.001
Income	0.040	0.016	1.041	2.552	0.011
Freq family makes demand	−0.192	0.057	0.826	−3.337	0.001
Feels worthy/equal to others	0.270	0.064	1.310	4.219	0.000
History of miscarriage/ stillbirth	−0.062	0.030	0.940	−2.073	0.039
Raped	−0.137	0.042	0.872	−3.241	0.001
Sexually molested as a child	−0.096	0.037	0.908	−2.625	0.009
Physically abused as a child	−0.129	0.056	0.879	−2.295	0.022
Difficulty paying bills	−0.184	0.063	0.832	−2.904	0.004
Health problems	−0.061	0.030	0.941	−2.052	0.041
Abortion	0.372	0.153	1.450	2.432	0.015
Abortion (unadjusted)	0.639	0.114	1.895	5.597	0.000
DV: Major depression with hierarchy					
Age	0.029	0.008	1.030	3.651	0.000
Income	0.040	0.016	1.041	2.450	0.015
Freq family makes demand	−0.121	0.059	0.886	−2.047	0.041
Feels worthy/equal to others	0.222	0.066	1.248	3.368	0.001
Sexually molested as a child	−0.100	0.038	0.905	−2.675	0.008
Physically abused as a child	−0.133	0.057	0.875	−2.349	0.019
Other terrible experience	−0.105	0.039	0.901	−2.713	0.007
Difficulty paying bills	−0.169	0.065	0.844	−2.597	0.010
Abortion	0.390	0.155	1.477	2.514	0.012
Abortion (unadjusted)	0.655	0.117	1.924	5.592	0.000

Table 6
Population attributable risk (PAR) Percentages for disorders with significant adjusted odds ratios based on abortion history.

Disorder	PAR (%)
Panic disorder	11.5
Panic attack	4.8
PTSD	6.2
Agoraphobia with/or without panic	9.7
Agoraphobia without panic	10.1
Alcohol Abuse with/or without dependence	10.2
Alcohol dependence	13.2
Drug abuse with/or without dependence	7.7
Drug dependence	12.2
Bipolar disorder	16.6
Major depression without hierarchy	4.3
Major depression with hierarchy	4.6

ulation for which the procedure made an independent contribution.

• Estimate of population exposure (Px) = c/(c+d); where c = n for the abortion group who were not afflicted with the mental illness in question and d = n for the no abortion group who were not identified as having the mental illness examined.

• Estimate of population attributable risk percentage = $100^{*}(Px^{*}(OR-1))/(1+(Px^{*}(OR-1)))$

4. Discussion

The results of this study revealed that women who have aborted are at a higher risk for a variety of mental health problems including anxiety (panic attacks, panic disorder, agoraphobia, PTSD), mood (bipolar disorder, major depression with and without hierarchy), and substance abuse disorders when compared to women without a history of abortion after controls were instituted for a wide range of personal, situational, and demographic factors. As noted above there were a number of demographic and personal history variables that differed systematically between women who had aborted and those who had not. In general, women with an abortion history were more likely to be older, more highly educated, black, separated, divorced, or widowed, live in smaller households, to have been working, to have reported a personal history of more sexual trauma in childhood and adulthood, and they identified more unusually stressful events in adulthood (miscarriage, having been physically attacked, and life threatening accident). Controlling for these variables is an essential design feature of studies pertaining to the mental health correlates of voluntary termination. Consider for example, one of these factors, history of miscarriage/stillbirth. In this study the abortion group when compared to the no abortion group was considerably more likely to have experienced a non-voluntary loss (31% versus 18.7%) and very few previous studies have included this control. The effects of miscarriage/stillbirth are well documented with approximately 25% likely to suffer from persistent, serious psychological problems (Harmon et al., 2000). With the variance associated with miscarriages/stillbirths and the number of children statistically removed, the groups in the present study were effectively equated relative to reproductive history. Interestingly non-voluntary losses only had an independent effect on 4 of the 15 psychiatric illnesses examined (drug abuse with or without dependence, drug dependence, mania, and depression without hierarchy).

What is most notable in this study is that abortion contributed significant independent effects to numerous mental health problems above and beyond a variety of other traumatizing and stressful life experiences. The strongest effects based on the attributable risks indicated that abortion is responsible for more than 10% of the population incidence of alcohol dependence, alcohol abuse, drug dependence, panic disorder, agoraphobia, and bipolar disorder in the population. Lower percentages were identified for 6 additional diagnoses.

Of the 15 disorders examined the only diagnoses not significantly associated with abortion after removing the effects of confounding variables were alcohol and drug abuse without dependence and mania. The mania diagnosis had fewer than 15 cases in each group, far too few to have confidence in the results. A lack of effects for alcohol or drug abuse without dependence is not surprising in that people periodically abuse substances for widely varying reasons including boredom, rebelliousness, curiosity, recreation, etc. without dependency and substance dependence is more likely to be related to emotional difficulties (Farrell et al., 2001; Raimo and Schukit, 1998).

The linkages between abortion and substance abuse/dependence, major depression, bipolar disorder, and PTSD add to the existing body of literature (Kessler and Walters, 1998; McQuaid et al., 2001). However, no previous studies have identified links between abortion and panic disorder, panic attacks, and agoraphobia. Some studies have identified biochemical similarities between PTSD and panic disorder (Risbrough and Stein, 2006), indirectly suggesting related processes may be involved in the associations between abortion and PTSD and between abortion and other anxiety disorders. Taylor and Arnow (1988) found that in adults the onset of most panic disorders begins with a spontaneous panic attack within six months of major stressful event. If women experience the abortion as a trauma, the event may trigger a psychological and/or physiological process that culminates in an anxiety disorder. More research is needed to understand the precise process mechanisms linking abortion with various anxiety disorders. Both the abortion and no abortion groups had higher than average rates of trauma of various forms and this may explain the relatively high proportion of women who met criteria for PTSD and other diagnoses.

There are several limitations of this research. Due to data constraints the subsample reported here included only 37.6% of the full NCS. Further, the NCS data does not include a variable related to pregnancy intendedness/wantedness, therefore it was not possible to compare women who aborted to women who carried an unintended/unwanted pregnancy to term. Although on the surface this may seem like an ideal control group to employ when examining the mental health effects of abortion, the utility of the intendedness and wantedness variables becomes nebulous when examined more closely. According to Finer and Henshaw (2006), "women's pregnancy intentions cannot always be accurately ascertained or neatly dichotomized." (p. 95). Santelli et al. (2006) also concluded: "traditional measures of pregnancy intentions did not readily predict a woman's choice to continue or abort the pregnancy." (p. 2009). Pregnancies that are aborted may have been initially intended by one or both partners and pregnancies that are initially unintended may become wanted as the pregnancy progresses. Moreover, after controlling for maternal age, education, marital status, number of people residing with the respondent, trimester in which prenatal care was sought, number of prior births, and all forms of reproductive loss, Coleman et al. (2005) found that experiencing an unwanted pregnancy was not related to excessive drug or alcohol consumption. Similarly, Joyce et al. (2000) reported that associations between pregnancy wantedness and negative maternal behaviors like substance abuse tend to be minimal after controlling for a comprehensive set of socio-demographic variables.

Most women are likely to experience a variety of reproductive events encompassing multiple pregnancies that continue or are terminated voluntarily or involuntarily with each characterized by distinct levels of intendedness over the course of their lives. Statistically controlling for all reproductive events may be the optimal method given the complex reproductive histories of most women. Controlling only for the intendedness of one pregnancy that is the focus of a study provides no assurance that the proportion of women in the abortion vs. delivery group are equivalent in terms of the intendedness and/or resolution of past or subsequent pregnancies. Future research might however address the mental health trajectories of women with varying combinations of wanted and unwanted pregnancies continued and terminated over an extended period of time. In this way, assessing both positive and negative aspects of a pregnancy in a woman's life might also provide improved understanding of these complex interrelationships.

The problem of women concealing a past abortion which plagues most studies on this topic was also potentially operative here. Additional limitations, the most important of which is probably recall error, are also obviously associated with retrospective data collection. Further, the results provided did not identify the percentage of women with an abortion history who may have suffered from more than one diagnosis. The data pertaining to the number of women who experience post-abortion mental health problems may be somewhat inflated by the failure to account for multiple diagnoses in one individual.

The strengths of this study included the use of a reasonably large nationally representative sample, quantification of risks, professional data collection, well-developed measures of numerous mental disorders examined as correlates of abortion history, and employment of a broad set of control variables. Research with

these methodological features is essential to the process of clarifying the mental health risks unique to abortion.

Future research is needed to shed light on mediating mechanisms linking abortion to various disorders and to decipher the characteristics of women most prone to developing a particular mental health problem. For example, women who have considered their options thoroughly yet remained ambivalent about an abortion based on personal beliefs and/or moral or religious proscriptions may become particularly prone to anxiety or depression when social support is lacking. Or alternatively, women who go through an abortion without much thought or difficulty initially may later find themselves battling a substance abuse problem as a way of numbing thoughts or feelings that emerge in the months or years following an abortion.

The topic of abortion and mental health has been vastly understudied and the progress of research in this area was stalled for a number of years as the literature contained a great deal of conflicting data regarding the basic question of whether or not abortion increases risk for mental health problems. The academic debate was fueled by socio-political agendas that impeded and at times contaminated scientific efforts. Recent years have however ushered in large scale, methodologically sophisticated studies, some of which were reviewed in the introduction segment of this article. These studies have now clearly established an increased risk for a variety of mental health problems in conjunction with abortion. To fully understand the documented risks and move toward developing professional therapy protocols for addressing mental health needs prior to, during, and in the years following an abortion, research efforts need to move beyond dated battles and become devoted to achieving a more substantive understanding of the meaning of abortion in women's lives.

Contributors

Priscilla K. Coleman, PhD: Conceptualization of study design, data analysis, interpretation of results, writing and editing of manuscript. Catherine T. Coyle, PhD: Consultation, interpretation of results, and assisted with writing and editing of manuscript. Martha Shuping, MD: Consultation, interpretation of results, and assisted with writing and editing of manuscript. Vincent M. Rue, PhD: Consultation, interpretation of results, and assisted with writing and editing of manuscript.

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